

REMARKS

Claims 1-6 are pending herein.

I. The objections to the claims.

Applicants respectfully note that claims 3 and 6 have been amended to clarify the claims and to resolve antecedent basis issues. No new matter is added by the amendments. Support for the amendments is found on page 6, lines 21-29 of the present specification.

Regarding the relation between the high dielectric constant metal constitutional element and the high dielectric constant insulating film, Applicants respectfully note the explanation at page 6, lines 21-29 of the present specification. For example, the high dielectric constant insulating film may be formed of the compound, HfAlO_x, of which Hf is a metal constitutional element. Additionally, the interface layer may include HfSiO₄, of which Hf is a metal constitutional element. Accordingly, the high dielectric constant metal constitutional element of the high dielectric constant insulating film is the same as the high dielectric constant metal constitutional element of the interface layer, as claimed in claims 3 and 6.

Thus, it is respectfully asserted that the claim objections have been overcome.

II. The obviousness rejections of claims 1 and 3 based on Cabral (US 2006/0138603) in view of Doh (US 2006/0115993) as noted no page 3 of the Office Action.

The USPTO respectfully rejects claims 1 and 3 under 35 U.S.C. § 103(a) as being unpatentable over Cabral and Doh. Claim 1 is an independent claim.

A. The cited references do not teach or suggest a diffusion suppressing layer provided on the interface layer, as claimed in claim 1.

Claim 1 claims in relevant part:

“a diffusion suppressing layer provided on the interface layer.” (emphasis added)

Regarding these limitations, it is respectfully not seen where the cited references teach or suggest the claimed structure quoted above.

For example, on page 3 of the Office Action, the USPTO respectfully notes that Cabral does not teach a diffusion suppressing layer provided on the interface layer. The USPTO respectfully attempts to overcome this deficiency in Cabral by citing paragraph [0009] of Doh.

However, it is respectfully important to note that Doh does not teach or suggest anything regarding a diffusion suppressing layer. Instead, Doh only purportedly teaches a high dielectric layer formed on a silicon substrate by nitriding the substrate. It is respectfully asserted that the high dielectric layer of Doh is different than a diffusion suppressing layer. Therefore, the nitrided high dielectric film of Doh cannot be the specifically claimed diffusion suppressing layer of claim 1.

In contrast, present Figure 1 illustrates at least one possible embodiment of the claimed structure quoted above. For example, present Figure 1 shows a diffusion suppressing film 6 provided on interface layer 5. It is respectfully important to note that diffusion suppressing film 6 is a separate and completely different layer than high dielectric constant insulating film; in other words, diffusion suppressing film 6 is not the same as a high dielectric layer, as the USPTO respectfully argues regarding the Doh reference. Thus, diffusion suppressing film 6 is one possible embodiment of the specifically claimed diffusion suppressing layer of claim 1.

The distinction noted above is important and non-trivial because it results in significant advantages over conventional devices. For example, as noted on pages 7-8 of the present specification, the specifically claimed diffusion suppressing layer of claim 1 allows for suppression of oxygen diffusion from the inside of high dielectric constant insulating film to the interface layer, thus preventing impairment of high-dielectric characteristics.

Thus, it is respectfully asserted that the cited references, taken either alone or in combination, do not teach or suggest all of the limitations of independent claim 1. Therefore, it is respectfully asserted that independent claim 1 is allowable over the cited references.

B. Further explanation.

Applicants respectfully note the following further explanation regarding Cabral and Doh.

It is respectfully asserted that neither Cabral nor Doh teaches or suggests the technical finding of the device of claim 1 of forming a diffusion suppressing layer between a metal silicate and a high dielectric constant insulating film in order to both: a) prevent degradation of transistor characteristics; and b) suppress diffusion of the constituent materials (for example, Hf) of said film to the silicon substrate and diffusion of oxygen contained in said film to an interface layer.

In other words, both Cabral and Doh do not address the problem that transistor characteristics are degraded due to existence of nitrogen near the interface of the Si substrate, and do not address eliminating nitrogen near the interface of the Si substrate. Accordingly, it is respectfully asserted that the structure of claim 1 would not be obvious based on the combination of Cabral and Doh.

C. The dependent claims.

As noted above, it is respectfully asserted that independent claim 1 is allowable, and therefore it is further respectfully asserted that dependent claim 3 is also allowable.

III. The obviousness rejections of claims 4-5 based on Harada (US 2002/0195643) in view of Cabral, as noted on page 5 of the Office Action.

The USPTO respectfully rejects claims 4-5 under 35 U.S.C. § 103(a) as being unpatentable over Harada in view of Cabral.

A. The cited references do not teach or suggest forming a diffusion suppressing layer, wherein the diffusing suppressing layer comprises nitrogen, as claimed in claims 4 and 5.

Claim 4 claims in relevant part:

“**forming a diffusion suppressing layer** on the surface of the initial layer;

...;

wherein the diffusion suppressing layer **comprises nitrogen.**” (emphasis added)

Claim 5 claims similar limitations. No new matter is added by the amendments. Support for the amendments is found on page 5 of the present specification. Regarding these limitations, it is respectfully not seen where the cited references teach or suggest the claimed method quoted above.

For example, the USPTO respectfully argues on page 5 of the Office Action that structure 11a of Harada is the specifically claimed diffusion suppressing layer of claims 4 and 5. However, Harada does not teach or suggest at all that structure 11a is a diffusion suppressing layer. Instead, as noted in paragraph [0075] of Harada, structure 11a is a “high dielectric constant film,” which is different than a diffusion suppressing layer. Therefore, structure 11a of Harada respectfully cannot be the specifically claimed diffusion suppressing layer of claims 4 and 5.

Additionally, structure 11a of Harada is formed of a hafnium oxide material that contains silicon (see paragraph [0075] of Harada), and does not include any nitrogen.

Thus, structure 11a cannot be the specifically claimed diffusion suppressing layer comprising nitrogen, as claimed in claims 4 and 5.

Cabral also does not overcome these deficiencies in the primary reference Harada. For example, as noted on page 4 of the Office Action regarding claim 1, Cabral does not teach a diffusion suppressing layer.

In contrast, present Figure 1 illustrates at least one possible embodiment of the claimed structure quoted above. For example, present Figure 1 shows a diffusion suppressing film 6 provided on interface layer 5. As explained on page 5 of the present specification, diffusion suppressing film 6 can be formed of a metal nitride or a metal oxide nitride. In other words, the diffusion suppressing film comprises nitrogen. It is respectfully important to note that diffusion suppressing film 6 is a separate and completely different layer than high dielectric constant insulating film; in other words, diffusion suppressing film 6 is not the same as a high dielectric layer, as the USPTO respectfully argues regarding the Doh reference. Thus, diffusion suppressing film 6 is one possible embodiment of the specifically claimed diffusion suppressing layer comprising nitrogen, as claimed in claims 4 and 5

The distinction noted above is important and non-trivial because it results in significant advantages over conventional devices. For example, as noted on pages 7-8 of the present specification, the specifically claimed diffusion suppressing layer of claim 1 allows for suppression of oxygen diffusion from the inside of high dielectric constant insulating film to the interface layer, thus preventing impairment of high-dielectric characteristics.

Thus, it is respectfully asserted that the cited references, taken either alone or in combination, do not teach or suggest all of the limitations of claims 4 and 5. Therefore, it is respectfully asserted that claims 4 and 5 are allowable over the cited references.

IV. The obviousness rejections of claims 2 and 6 based on Cabral in view of Doh and Bai (US 2001/0013629), as noted on page 8 of the Office Action.

As noted above, it is respectfully asserted that independent claim 1 is allowable, and it is further respectfully asserted that Bai does not overcome the deficiencies in Cabral and Doh as noted above in Section II regarding independent claim 1. Therefore, it is further respectfully asserted that dependent claims 2 and 6 are also allowable.

V. Conclusion.

Reconsideration and allowance of all of the claims is respectfully requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Please contact the undersigned for any reason. Applicants seek to cooperate with the Examiner including via telephone if convenient for the Examiner.

Respectfully submitted,

By: / Daniel P. Lent/

Daniel P. Lent

Registration No. 44,867

Date: May 5, 2009
CANTOR COLBURN LLP
20 Church Street
22nd floor
Hartford, CT 06103-3207
Telephone (860) 286-2929
Facsimile (860) 286-0115
Customer No.: 23413